INTRODUCTION

A. *MILITARILY CRITICAL TECHNOLOGIES PART III OVERVIEW*

Developing Critical Technologies identifies those technologies that will produce increasingly superior performance of military systems or maintain a superior capability more affordably. The object of the document is to look beyond the Department of Defense (DoD) planning period (5+ years) and as far into the future as is reasonable. Although it may not be possible to identify all technologies that will be used in future military systems, the focus will be on those technologies that have the greatest potential of fulfilling the requirements outlined by the Joint Chiefs of Staff (JCS) and the respective Services in their visions and Science and Technology (S&T) plans.

Today, many centers of technical expertise are developing and bringing new technologies to the commercial and military markets on a global basis. Key for U.S. military success will be the ability to learn of these advancing technologies and gain access to them when needed for use by U.S. forces.

Many technologies, especially those used in the commercial marketplace, will continue to be developed at amazing speed (6 to 18 months from one generation of capability to the next). This has been true in recent years for various technologies, including the fields of microchips, biotechnology, electro-optics, microminaturization, and new materials and compounds.

Military acquisition cycles of 12 to 20 years will require that some technology choices be delayed until the last minute so that the latest state-of-the-art items will be included in the fielded system. Even after fielding, most systems will have a life cycle sufficiently long to require ongoing updates with new technology as it becomes available. This requires that interfaces in the original item achieve an open system configuration that will allow for low-cost and simple-to-execute updates that can be accommodated with minimal design changes and minimal impact to the major structural system.

Some military systems will be unable to take advantage of the economies of scale in production because of the limited numbers finally produced. Adaptation of commercial technologies for military application may have the greatest potential advantage in the economy of scale. Common subcomponents and interfaces will provide savings across the board.

These dynamics establish the need to identify developing critical technologies. Part III presents information on what is important, why it is important, where the technology will be developed, and how DoD can gain access to this technology to integrate it into a major military system.

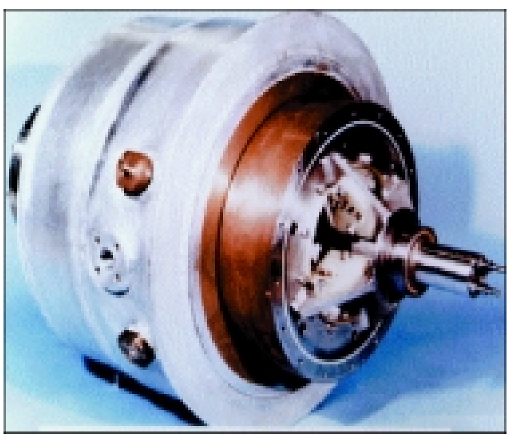
Because of these factors, Part III, *Developing Critical Technologies*, is being produced to provide DoD with an understandable compendium that has the potential for future military use in achieving the using community's long-term goals.

B. CONTEXT AND BACKGROUND

Joint Vision 2010 is the conceptual template for how the U.S. Armed Forces will channel the vitality and innovation of its people and leverage technological opportunities to achieve new levels of effectiveness in joint warfighting. This vision of future warfighting embodies the improved intelligence and command and control (C2) available in the information age and goes on to develop four operational concepts: dominant maneuver, precision engagement, full dimensional protection, and focused logistics.

Our most vexing future adversary may be one who can use technology to make rapid improvements in its military capabilities that provide asymmetrical counters to U.S. military strengths. Within the next 15 to 20, years the United States expects to face the development and improvement of several weapons capabilities. Of particular concern are weapons of mass destruction (WMD); long-range precision weapons; reconnaissance, surveillance, and target acquisition (RSTA) capabilities; counters to precision strike capabilities; and information warfare.

The future will be an era of accelerating technological change that will impact all military forces. Long-range precision capability, combined with a wide range of delivery systems, is emerging as a key factor in future warfare. Advances in low observable technologies and the ability to mask friendly forces will continue. The detectability of targets will be enhanced across the battlespace by multispectral sensing, automated target recognition, and other advances. Improvements in information and system integration will significantly affect military operations. The combination of these technology trends may provide multiple orders-of-magnitude improvement in lethality. Commanders will be able to attack targets successfully with fewer platforms and less ordnance while achieving objectives more rapidly. Individual warfighters will be empowered—as never before—with an array of detection, targeting, and communications equipment that will greatly magnify the power of small units. Strategically, this improvement will enable more rapid power projection. Technologies that address the logistics burden of responding to threats through deployment of troops and associated resources will become increasingly important in the future. The inability to meet mandatory deployment objectives results in significant and costly delays. Some of the technologies that address this area are logistics management (information technologies), supply chain management, and rapid production.



Information superiority and advances in technology will enable the United States to achieve the desired effects through the tailored application of joint combat power. Improved C2, based on fused, all-source, real-time intelligence, will reduce the need to assemble maneuver formations days and hours in advance of attacks. Providing improved targeting information directly to the most effective weapon system will potentially reduce the traditional force requirements at the point of main effort.

In sum, by 2010, the United States should be able to enhance greatly the capabilities of its forces through more rapid adaptation of state-of-the-art technology.

C. ORGANIZATION OF PART III

Part III contains 20 sections, each devoted to a specific technology area.

Each section contains the following:

- *Scope* identifies the technology groups covered in the section. Each group is covered in a separate subsection.
- *Highlights* identifies the key facts found in the section.
- *Overview* discusses the technology groups identified under "Scope."
- *Rationale* indicates why the technology groups are important for future military use.
- *Background* provides additional information.
- *Technology Assessment* covers significant technology trends that will influence the capability or availability of the technologies as well as affordability factors.
- *Worldwide Technology Assessment (WTA),* with accompanying figure, provides summary estimates of worldwide capabilities. These estimates are expert judgments by the Technology Working Groups (TWGs).

For each technology group identified under "Scope," there is a subsection that contains the following:

- *Highlights* identifies the key facts found in the subsection.
- *Overview* identifies and discusses technologies listed in data sheets that follow.
- *Rationale* indicates why listed technologies are important for future military use.
- *Worldwide Technology Assessment (WTA),* with accompanying figure, provides a more detailed technology description than in the WTA section in the specific technology area.
- *Data Sheets,* which are the heart of Part III, present data on developing critical technologies. The principal data element is the **Developing Critical Technology Parameter**, which is the technology parameter expected to be attained. Each data sheet has its own WTA, with accompanying figure.

D. WORLDWIDE TECHNOLOGY ASSESSMENT

The list of militarily critical technologies includes estimates of worldwide capabilities in each of the designated technology areas and in each individual technology. These estimates are called Worldwide Technology Assessments, or WTAs. WTA estimates are the scientific and technological consensus of the TWG members from industry, government, and academia. Collaboration with the Intelligence Community is an essential part of the WTA determination, and selected members of the Intelligence Community are TWG members who participate regularly in the militarily critical technology process. These WTAs are worldwide capability assessments and do not constitute *findings* of foreign availability, which are the responsibility of the Department of Commerce (DOC) under the Export Administration Act (EAA).

Developing Critical Technologies expands the use of the WTAs found in Parts I and II. Summary charts have been developed for each technology area, for each subsection grouping, and on individual technology data sheets. One to four circles (four being the highest) are assigned for status of research and development (R&D) efforts. Four circles indicate that the country is involved in extensive R&D; three circles indicate that the country has significant R&D; two circles indicate that the country has moderate R&D; and one circle indicates that the country has limited R&D. An absence of circles (or a country) may indicate a lack of information—not of R&D efforts. This is an assessment of R&D efforts/capability and not an assessment of expected success.